

REMARKS

I. Introduction

In response to the Office Action dated January 28, 2005, Applicants have canceled claims 7-21, without prejudice or disclaimer. Applicants have also amended claim 1 so as to further clarify the claimed subject matter. New claims 22 and 23 are added. Support for these amendments can be found, for example, in Fig. 1 and its corresponding section of the specification. No new matter has been added.

For the reasons set forth below, Applicants respectfully submit that all pending claims are patentable over the cited prior art references.

II. The Rejection Of Claims 1-6 Under 35 U.S.C. § 103

Claims 1-6 are rejected under 35 U.S.C. §103(a) as being unpatentable over USP No. 6,048,766 to Gardner in view of USP No. 6,674,138 to Halliyal. Applicants respectfully traverse this rejection for at least the following reasons.

Claim 1 recites in-part that the intermediate insulator film comprises a hafnium oxide that contains nitrogen atoms. In the pending rejection, the Examiner admits that the intermediate insulator film 212 of Gardner does not include a hafnium oxide that contains nitrogen atoms, but alleges that the first oxide layer 28 of Halliyal contains hafnium silicon oxynitride, as cited in col. 6, lines 20-24 and col. 13, lines 25-36 (see, page 3, lines 3-7 of Office Action).

However, Applicants respectfully disagree with the Examiner's interpretation, because Halliyal discloses only that the high-K dielectric material layer 30 contains hafnium silicon oxynitride (see, col. 5, lines 10-11 and lines 60-61, and col. 6, lines 9-16) and Halliyal does not disclose or suggest the alleged intermediate insulator film 28 as having hafnium silicon

oxynitride in the manner perceived by the Examiner. This is evidenced by the express objective given in Halliyal; namely, replacing the nitride layer of the oxide-nitride-oxide (ONO) structure with a high-K dielectric material comprising metal oxides including hafnium oxide or hafnium silicon oxynitride, (see, col. 1, line 32, col. 5, lines 32-38 and TABLE 1) allows “the modified ONO structure ... [to have] a low electrical thickness ... even with a physically thick layer (see, col. 6, lines 19-22).”

If the pending rejection is maintained, it is respectfully requested that the next Office Action identify the specific section of Halliyal as disclosing the first oxide layer 28 as having hafnium silicon oxynitride so that the Applicants may further address and/or rebut these issues.

Additionally, claim 1 recites an intermediate insulator film that is *directly* formed between at least one of the pairs consisting of the floating gate electrode and the ferroelectric film, and the ferroelectric film and the control gate electrode.

In accordance with one exemplary embodiment of the present invention, an intermediate insulator film is placed between the floating gate electrode and the ferroelectric film, or between the ferroelectric film and the control gate electrode of the semiconductor device. As a result, the leakage current flowing from the control gate electrode can be reliably prevented, thus extending the retention time of the semiconductor device (see, e.g., page 18, lines 8-24 of the specification).

In direct contrast, the flash memory device of Gardner requires a first layer of titanium dioxide 214a to be interposed between the alleged floating gate electrode 202 and ferroelectric film 216, and a second layer of titanium dioxide 214b to be interposed between the alleged ferroelectric film 216 and control gate electrode 204, so that the alleged intermediate insulator films 212a and 212b (alleged intermediate insulator films) are *not* directly formed between the

alleged floating gate electrode 202 and the alleged ferroelectric film 216, or between the alleged ferroelectric film 216 and the alleged control gate electrode 204, respectively. Halliyal does not cure this defect of Gardner, because the first oxide layer 28 of Halliyal is not equivalent to the claimed intermediate insulator film for the reasons discussed above. Even assuming *arguendo* that the high-k dielectric layer 30 of Halliyal can arguably be interpreted as the claimed intermediate insulator film, it is noted that the high-k dielectric layer 30 of Halliyal is *not* in contact with the floating gate electrode 44 or the control gate electrode 46.

Furthermore, the pending rejection applies the first oxide layer 28 of Halliyal to that of the silicon nitride layers 212a/212b of Gardner. The Examiner is directed to M.P.E.P § 2143.01 under the heading “THE PROPOSED MODIFICATION CANNOT RENDER THE PRIOR ART UNSATISFACTORY FOR ITS INTENDED PURPOSE” which sets forth the applicable standard:

If proposed modification would render the prior art invention being modified unsatisfactory for its intended purpose, then there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984).

In the instant case, it is noted that the silicon nitride layers 212a/212b of Gardner serve as buffer layers for the high permittivity barium strontium titanate layer 216 and the polysilicon plates 202/204 (see, col. 3, lines 28-33). In contrast, the first oxide layer 28 of Halliyal serves as a tunnel oxide layer for the ONO structure 26. Thus, if Gardner is to be modified to practice the teachings of Halliyal in the manner alleged by the pending Office Action, the silicon nitride layers 212a/212b of Gardner would be replaced with the first oxide layer 28 of Halliyal so that Gardner will no longer be provided with buffer layers. It is clearly improper to simply pick and choose selected elements of the prior art to reconstruct the claimed invention. Thus, it is respectfully submitted that the proposed combination is based solely on improper hindsight

reasoning, whereby the pending rejection selected bits and pieces of the claimed invention from various references and used only Applicants' specification as a guide to reconstruct the claimed invention. Accordingly, because the proposed modification renders the prior art unsatisfactory for its intended purpose, it is respectfully submitted that there is no suggestion or motivation to make the proposed modification. *In re Gordon*, 733 F.2d 900, 221 USPQ 1125 (Fed. Cir. 1984). Therefore, the proposed combination fails to establish *prima facie* obviousness of the pending claims.

As a final note, it is suggested that "it would have been obvious ... to modify the device of Gardner by incorporating the intermediate insulator film ... to allow a low electrical thickness to be achieved even with a physically thick layer as taught by Halliyal." However, it is important to note that the purported motivation found in Halliyal stems from a modified ONO structure (see, col. 6, lines 19-22). However, as the structure of Gardner is *not* an ONO structure, it is respectfully submitted that the alleged motivation is inapplicable to the flash memory device of Gardner. That is, there is no disclosed need, desire or purpose for replacing the silicon nitride layers 212a/212b of Gardner with the first oxide layer 28 of Halliyal. Accordingly, it is respectfully submitted that there is no motivation for making the proposed modification.

It should also be recognized that the fact that the prior art could be modified so as to result in the combination defined by the claims at bar would not have made the modification obvious unless the prior art suggests the desirability of the modification. *In re Deminski*, 796 F.2d 436, 230 USPQ 313 (Fed. Cir. 1986).

Moreover, recognizing after the fact that such a modification would provide an improvement or advantage, without suggestion thereof by the prior art, rather than dictating a conclusion of obviousness, is an indication of improper application of hindsight considerations.

Simplicity and hindsight are not proper criteria for resolving obviousness. *In re Warner*, 379 F.2d 1011, 154 USPQ 173 (CCPA 1967).

It is only Applicants' disclosure that discloses the claimed semiconductor device. Neither Gardner nor Halliyal disclose or suggest such a method. Thus, the only motivation of record for the proposed modification of the flash memory of Gardner to arrive at the claimed invention is found in Applicants' disclosure which, of course, may not properly be relied upon to support the ultimate legal conclusion of obviousness under 35 U.S.C. § 103. *Panduit Corp. v. Dennison Mfg. Co.*, 810 F.2d 1561, 2271 USPQ2d 1593 (Fed. Cir. 1987).

Thus, as each and every limitation must be either disclosed or suggested by the cited prior art in order to establish a *prima facie* case of obviousness (see, **M.P.E.P. § 2143.03**), and Gardner and Halliyal, alone or in combination, fail to do so, it is respectfully submitted that claim 1 is patentable over the cited prior art.

III. All Dependent Claims Are Allowable Because The Independent Claims From Which They Depend Are Allowable

Under Federal Circuit guidelines, a dependent claim is nonobvious if the independent claim upon which it depends is allowable because all the limitations of the independent claim are contained in the dependent claims, *Hartness International Inc. v. Simplimatic Engineering Co.*, 819 F.2d at 1100, 1108 (Fed. Cir. 1987). Accordingly, as independent claim 1 is patentable for the reasons set forth above, it is respectfully submitted that all claims dependent thereon are also in condition for allowance.

Furthermore, new claims 22 and 23 recite the floating gate electrode comprises silicon or metal, and the ferroelectric film comprises silicon or metal, respectively. However, it does not

appear that Gardner and Halliyal disclose or suggest the aforementioned features. Thus, it is respectfully submitted that claims 22 and 23 are patentable over the cited prior art.

IV. Conclusion

Accordingly, it is urged that the application is in condition for allowance, an indication of which is respectfully solicited.

If there are any outstanding issues that might be resolved by an interview or an Examiner's amendment, the Examiner is requested to call Applicants' attorney at the telephone number shown below.

To the extent necessary, a petition for an extension of time under 37 C.F.R. § 1.136 is hereby made. Please charge any shortage in fees due in connection with the filing of this paper, including extension of time fees, to Deposit Account 500417 and please credit any excess fees to such deposit account.

Respectfully submitted,

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